छत्रपति शाहू जी महाराज विश्वविद्यालय, कानपुर

CHHATRAPATI SHAHU JI MAHRAJ UNIVERSITY, KANPUR

(पूर्ववर्ती कानपुर विश्वविद्यालय कानपुर)

Formerly Kanpur University, Kanpur – 208024

A Documentary Support

For

Matric No. – 1.1.1

Programme Outcomes & Course Outcomes

Under the

Criteria - I

(Curriculum Design and Development)

Key Indicator - 1.1

In

Matric No. – 1.1.1

M.Sc. Life Sciences

Co-ordinator
Internal Quality Assurance Cell
CSJM University, Kanpur

(Registrar)
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Kanpur

REGISTRAR
C.S.J.M. UNIVERSITY
KANPUR

Chhatrapati Shahu Ji Maharaj University, Kanpur
Department of Life Sciences
M.Sc. Life Sciences
Course – Structure

A. **Programme outcome of life sciences-** Students will learn basic concepts of plant and animal physiology and biochemistry, which will lead to in-depth understanding of living cells. The programme curriculum will also enable students to get hands on exposure to advanced aspects of life science including genetic engineering, *omics* technology, carcinogentics and drug discovery. Topics such as virology, microbial physiology will give students a holistic approach of microbes and their role in human development. The programme will give ample opportunities to students to get employability as well as entrepreneurship**.**

B. **Programme specific outcome** - There are two specific programme by which students can learn cutting edge topics of life sciences

   a. **Nanobiotechnology**- To explain about the background on nanoscience and its applications. To understand the synthesis of nanomaterials and their application and the impact of nanomaterials on environment. To apply their learned knowledge to develop Nanomaterial's. To apply Nanotechnology and may apply their skills in research laboratories and pharmaceutical industries.

   b. **Redox Biology-** After this course, student will understand of advances in systems biology that have led to the realization that redox reactions play an important role in many diseases. They can understand the basic principles focusing on various aspects of five primary areas of redox biochemistry: Antioxidant molecules and redox cofactors; Antioxidant enzymes; Redox regulation of physiological processes; Pathological processes related to redox. Redox enzymology, mycobacterial drug targets, immunology, neurophysiology and oxygen sensing, and will understand the role of redox biochemistry in medicine. They should know the important aspects of Hydrogen peroxide as major redox metabolite operative in redox sensing, signaling and redox regulation.

   c. **Course Out come- These are following**

M.Sc. Life Sciences Ist Semester Course Title - Physics (Remedial)
Course Code - L.Sc. - 1001
Course Outcome(s)

1. Students will be able to apply various fundamental principles and laws of Physics for learning the processes in Life Sciences.
2. Application of the knowledge of fundamental and applied physics for learning concepts for any given requirement in basic and applied Life Sciences.

1. Students will be able to perform and represent studies of a physical situation by means of appropriate mechanisms.
2. To solve problems in an organized, methodical fashion, showing all work and explaining each step.
3. Students will be able to solve problems involving several main steps, and to solve problems involving more than one principle or law.

M.Sc. Life Sciences Ist Semester Course Title - Mathematics (Remedial)
Course Code - L.Sc. – 1002
Course Outcome(s)

1. Students will be able to calculate the various equational parameters of Life Sciences by using various mathematical models.
2. Apply the knowledge of fundamental and applied mathematics to calculations-based concepts for any given requirement in basic and applied Life Sciences.
3. Students will be able to perform abstract mathematical reasoning.

M.Sc. Life Sciences Ist Semester Course Title - Plant Biology (Remedial)
Course Code - L.Sc. - 1003
Course Outcome(s)

1. How do plants detect, process, and interpret information from the environment.
2. Important processes of plant survival and reproduction.
3. Development and reproduction of plants with overview of different processes.
4. Equip the students with subject domain knowledge and technical skills pertaining to plants in a holistic manner.

M.Sc. Life Sciences Ist Semester Course Title - Animal Biology (Remedial)
Course Code - L.Sc. – 1004
Course Outcome(s)

1. Appreciate the cell, tissue structure and function in animals including human
2. Explain the cell and its physiology and it's all functions
3. Capable to impart various advance aspects of advance animal cell structure and physiology, developmental biology and biotechnology including applied aspects of animal sciences

M.Sc. Life Sciences Ist Semester Course Title - Chemistry of Macromolecules
Course Code - L.Sc. – 1005
Course Outcome(s)

1. Solve the conceptual questions using the quantum mechanical model of the atom, quantum numbers, electronic configuration, angular distribution curves, shapes of s and p and d orbital, periodicity in atomic radii, ionic radii, ionization energy, electron affinity of elements
2. Draw the possible structures and geometry of molecules using radius ratio rules, VSEPR, MO diagrams
3. Understand the concept of lattice energy using BORN LANDE and KAPUSTINKI expression

4. Rationalize the conductivity of metals, semiconductors, insulators based on band theory
5. Application of chemical bonds, inter molecular and intra molecular weak chemical forces and their effect on melting points , boiling points, solubility and energetic of dissolution

M.Sc. Life Sciences Ist Semester Course Title – Biochemistry – I

Code - L.Sc. – 1006

Course Outcome(s)

1. Gain fundamental knowledge in biochemistry including major biomolecules.
2. Understand the molecular basis of various pathological conditions from the perspective of biochemical reactions.

M.Sc. Life Sciences Ist Semester Course Title – Microbiology

Code - L.Sc. – 1007

Course Outcome(s)

The student will be able to understand

1. Importance of microbes in the environment
2. With this study student can opt the various field of microbiology such as Pharmacy, Medicine, clinical research, agriculture, dairy industry, water industry, nanotechnology & chemical technology and they can make careers in research and non-research fields.

M.Sc. Life Sciences Ist Semester Course Title - Cell Biology – I

Code - L.Sc. – 1008

Course Outcome(s)

1. Students will learn how cellular information is passed on in eukaryotes and prokaryotes, how cells work together in a complex manner in biological system.
2. Students will gain the concept of cellular basic of life as a key mechanism of regulation of genes in the cellular development and cell fate.
3. The students will be able to understand how the cell functions as a unit of life.
4. Candidate shall be able to design and comprehend experimental strategies for analysing the cell and cell functions from a variety of organisms.
5. Students will be skilled in the techniques and experiments that contributed to the understanding of molecular mechanisms of the cellular processes.

M.Sc. Life Sciences Ist Semester Course Title – Genetics

Code - L.Sc. – 1009

Course Outcome(s)

Genetics course will open up several avenues for students in terms of research and employability and

1. Enable students for extensive use of model organisms, many of which will be used to teach this course.
2. By observing genetic mutations, students can correlate phenotype with genotype, understand genetic interaction and their molecular basis.
3. Students will be able to set hands on genetic crosses to understand recessive and dominant, segregation, pattern of inheritance and finally evaluating statistical significance by counting the progeny as statistical analysis

4. Students will learn how genetic information is passed on in eukaryotes and prokaryotes, how genes work together in a complex manner in biological system and any alteration can lead to major phenotypic change.
5. Students will appreciate the concept of epigenetics as a key mechanism of regulation of gene expression steering development and cell fate that can ultimately be affected in disease condition.

M.Sc. Life Sciences Ist Semester Course Title – Life Sciences Practical's

Code - L.Sc. - 1010

Semester – II

M.Sc. Life Sciences IInd Semester Course Title – Cell Biology – II

Code - L.Sc. -2001

Course Outcome(s)

The students will

1. Be able to understand how the cell functions as a unit of life.
2. gain knowledge about the techniques and experiments that contributed to the understanding of molecular mechanisms of the cellular processes.
3. be able to draw parallels between the physiological processes at the cellular and organismic levels.
4. Be able to understand the importance of cell-cell adhesion and the extracellular matrix in the evolution of multicellular organisms.

M.Sc. Life Sciences IInd Semester Course Title – Biochemistry – II

Code - L.Sc. -2002

Course Outcome(s)

1. Comprehend and analyze problem-based questions.
2. Develop investigative, communicative, analytical and personal skills with respect to the subject.
3. Recognize and explain how all physiological systems work in unison to maintain homeostasis in the body and feedback loops control the same.
4. Synthesize ideas to make connection between knowledge of physiology and real world situations, including healthy life style decisions and homeostatic imbalances i.e. how physiological mechanisms adapt in response to various external and internal stimuli in order to maintain health.
5. Know the role of regulatory systems viz. endocrine and nervous systems and their amalgamation in maintaining various physiological processes.
5. Appreciate the role of enzymes in metabolic pathways. And control of enzyme activity, its mechanism of action and how a drug might inhibit the enzyme.
7. Develop practical learning skills; like qualitative estimation of carbohydrates, chromatography and interpretation of results

M.Sc. Life Sciences IInd Semester Course Title – Molecular Biology

Code - L.Sc. -2003

Course Outcome(s)

The students will be able to understand:

1. how different genomes are packaged and organized

2. various transposable DNA elements and their mechanism of transposition and other DNA recombinations
3. various Molecular Biology processes like replication, transcription, translation in depth
4. control and regulation of various life processes at molecular level
5. understand the possible applications of molecular biology knowledge for recombinant DNA technology

M.Sc. Life Sciences IInd Semester Course Title – Immunology

Code - L.Sc. -2004

Course Outcome(s)

1. Explain the cellular and molecular aspects of lymphocyte activation, homeostasis, differentiation and memory.
2. Understand the molecular basis of complex, humoral (cytokines, complement) and cellular processes involved in inflammation and immunity, in states of health and disease.
3. Describe basic and state-of-the-art experimental methods and technologies.
4. Integrate knowledge of each subsystem to see their contribution to the functioning of higher-level systems in health and disease including basis of vaccination, autoimmunity, immunodeficiency, hypersensitivity and tolerance.

M.Sc. Life Sciences IInd Semester Course Title – Biophysics and Structural Biology

Code - L.Sc. -2005

Course Outcome(s)

On completion of this course, students should learn how to combine previously acquired knowledge of physical chemistry and biochemistry to understand biochemical processes at molecular level.

M.Sc. Life Sciences IInd Semester Course Title – Animal Physiology

Code - L.Sc. -2006

Course Outcome(s)

1. To investigate the biological processes that occur for animal life to exist.
2. These processes can be studied at various levels of organization from membranes through to organelles, cells, organs, organ systems, and to the whole animal.
3. A branch of biology, its focus is in how organisms, organ systems, organs, cells, and biomolecules carry out the chemical or physical functions that exist in a living system.

M.Sc. Life Sciences Semester - II Course - Title – Plant Physiology

Code - L.Sc. -2007

Course Outcomes

After this course, the students would be able
1. to understand various physiological life processes in the plants.
2. To gain insights about the various uptake and transport mechanisms in plants and understand the various physiological processes.
3. To understand the role of various hormones, signalling compounds, channel or transport proteins involved in nutrient uptake in plants.
4. To enrich themselves with the phenomenon of metabolism of primary and secondary metabolites and their role in plants.

M.Sc. Life Sciences IInd Semester Course Title – Life Sciences Practicals - II

Code - L.Sc. -2008

Semester — III

Course Title- Animal Development Biology: L.Sc. - 3001

Course Outcome(s)

The students shall be capable to understand

1. how an organism develops
2. how a single cell becomes an organized grouping of cells.
3. all aspects of plant and animal development, including stem cell biology and regeneration.

M.Sc. Life Sciences IIIrd Semester Course Title – Plant Developmental Biology

Code - L.Sc. -3002

Course Outcome(s)

After this course, student will develop the

1. Understanding of growth, development and reproduction in plants as well as understand the physiological and metabolic changes happening along with the environmental impact.
2. The students will learn about different aspects of plant development, like leaf, root and flower and genes controlling their function.
3. They will understand seed dormancy, vernalization for flowering and its applications.
4. Will enable students to understand various commercialised applications evolved from basic studies for improving many aspects of plants.

M.Sc. Life Sciences IIIrd Semester Course Title – Computational Biology & Bioinformatics

Code - L.Sc. -3003

Course Outcome(s)

1. This paper will lead to make students understand about the fundamentals of computer systems, hardware and software which will be utilized in learning the advances of the course.
2. The course will make students advanced in understanding the molecular interactions inside cell especially the structural details of protein and nucleic acids.
3. Students will specifically gain knowledge about the genomic and proteomic tools and techniques for understanding intermolecular interactions.
4. Students will be able to develop training in the field of Bioinformatics with specific emphasis for fulfilling expectations of Pharmacy, Chemical and Biotech industry.

M.Sc. Life Sciences IIIrd Semester Course Title – Biostatistics

Code - L.Sc. -3004

Course Outcome(s)

After successful completion of this course, students are expected to:

1. Define and describe important concepts such as: sampling, sample size calculation, tests of significance, correlation and regression analysis.
2. Gain broad understanding in statistics.

3. Recognize importance and value of statistical thinking, training, and approach to problem solving, on a diverse variety of disciplines.
4. Apply these concepts to problems related to the genetic dynamics of natural, captive and artificially selected populations or other relevant biological studies.

M.Sc. Life Sciences IIIrd Semester Course Title – Molecular Genetics & Genetic Engineering

Code - L.Sc. -3005

Course Outcome(s)

The students shall

1. Recall the principles of genetic engineering and the vectors used in cloning, methods of introduction of gene and expression
2. Appreciate the different cloning strategies and their expression
3. Know about implementation of genetic engineering for different purposes
4. Investigate the different strategies of recombinant DNA technology and resolve the problems encountered

M.Sc. Life Sciences IIIrd Semester Course Title – Molecular Cancer Biology

Code - L.Sc. -3006

Course Outcome(s)

1. Understanding genomic basis of cancer
2. Explaining key technologies and interact with public databases;
3. Understanding biology of various cancers and role of environment in carcinogenesis.

M.Sc. Life Sciences IIIrd Semester Course Title – Virology

Code - L.Sc. -3007

Course Outcome(s)

The course will provide students

1. The knowledge about the elements of the viral life cycle.
2. Explain the rationale behind the Baltimore classification system of viruses and present example viruses for each Baltimore group.
3. Explain viral replication strategies; and compare and contrast replication mechanisms used by viruses relevant for human disease.
4. Will learn about the host antiviral immune mechanisms at a cellular and molecular level and will able to describe viral strategies to evade host immune and cellular factors.
5. Will learn about the vaccine strategies and mechanisms of antiviral drugs.

M.Sc. Life Sciences IIIrd Semester Course Title – Advanced Microbial Physiology

Code - L.Sc. -3008

Course Outcomes (s)

Students should be able to:

1. Identify major categories of microorganisms and analyze their classification, diversity, and ubiquity;
2. Identify and demonstrate structural, physiological, genetic similarities and differences of major categories of microorganisms.
3. Identify and demonstrate how to control microbial growth;
4. Demonstrate and evaluate interactions between microbes, hosts and environment.

M.Sc. Life Sciences IIIrd Semester Course Title – Neurophysiology

Code - L.Sc. -3009

Course Outcome(s)

The students will be able to

1. Describe neuro physiological concepts, principles and mechanisms underlying normal functioning and explain their relationships to normal and pathological functioning of the individual
2. Identify key components of the etiology, the epidemiology and the clinical characteristics of common neurological conditions associated with malfunctioning of brain structures and appreciate factors leading to a differential diagnosis
4. Identify key components of the medical treatment, surgical interventions and rehabilitation associated with common neurological conditions and understand the impact of such treatment on the functional outcome of clients

M.Sc. Life Sciences IIIrd Semester Course Title – Enzymology and Enzyme Technology

Code - L.Sc. -3010

Course Outcome(s)

On completion of this course, students should be able to:

1. Gain fundamental knowledge in enzymes and enzyme-chemistry.
2. Understand the molecular basis of various enzymatic reactions under conditions from the perspective of biochemical reactions.

M.Sc. Life Sciences IIIrd Semester Course Title – Pluripotent Stem Cells & Reproduction

Code - L.Sc. -3011

Course Outcome(s)

After this course, student will

1. Develop the understanding of stem cells, types of stem cells, describe the medical uses for stem cells.
2. Learn the properties that defines a stem cell.
3. Different types of stem cells, usage of stem cells to understand and treat diseases. Methods of production and maintenance of stem cells with biological niche.
4. Various concepts like induced pluripotency, trans differentiation by nuclear reprogramming and their applications and products launched in the market.

M.Sc. Life Sciences IIIrd Semester Course Title – Ecology and Biodiversity

Code - L.Sc. -3012

Course Outcome(s)

1. Capacity for scientific studies by human beings in search of social and economic benefits.
2. Apply the knowledge for Genetic biodiversity (study at gene level). Species biodiversity (study of varieties of species in nature)
3. Manage wildlife, ecosystem, water conservation and sustainable development.

Semester — IV

M.Sc. Life Sciences IVth Semester Course Title – Neural and Behavioural Biology

Code - L.Sc. - 4001

Course Outcome(s)

After completion of this course, students should be able to:

1. Describe the complete range of neurodevelopmental basics.

2. Describe the stages of consciousness that affect learning, memory, behaviour and chronobiological regulation.
3. Apply the principles of technology to study synaptic plasticity in models for neurodevelopmental disorders

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M.Sc. Life Sciences IVth Semester Course Title – Plant Biotechnology
Code - L.Sc. – 4002
Course Outcome(s)

The students shall be able to:

1. demonstrate knowledge for in-depth analytical and critical thinking to identify, formulate and solve the issues related to Biotechnology Industry, Pharma industry, Medical or hospital related organizations, Regulatory Agencies, & Academia.
2. appreciate and execute their professional roles in society as biotechnology professionals, employers and employees in various industries, regulators, researchers, educators and managers
3. establish different types of plant cultures.
4. apply the technical skills learnt to establish nurseries for horticultural and agricultural crops.
5. compare the pros and cons of transgenic plants on environment
6. explain the concepts of intellectual property management and handling of GMOs.

M.Sc. Life Sciences IVth Semester Course Title – Molecular Parasitology
Code - L.Sc. – 4003
Course Outcome(s)

1. Knowledge to identify parasitism, parasites and their examples.
2. Describe disease of mode of diagnosis, control of parasites infections, understanding parasites host relationship student become right use of microscopes, using computer and internet, conducting documentary
3. About some parasites throw out the kingdom.
4. Helpful to develop the ability to work as a member of team to conduct a specific project

M.Sc. Life Sciences IVth Semester Course Title – Radiation Biology
Code - L.Sc. – 4004
Course Outcome(s)

The students will learn about

1. Impact of different radiations on living systems, radiation induced mutagenesis.
2. They will learn that during the passage through living matter, radiation loses energy by interaction with atoms and molecules of the matter, thereby causing ionization and excitation. The ultimate effect is the alteration of the living cells.

M.Sc. Life Sciences IVth Semester Title – Redox Biology
Code - L.Sc. – 4005
Course Outcome(s)

After this course, student will

1. Understand of advances in systems biology that have led to the realization that redox reactions play an important role in many diseases.
2. Understand the basic principles focusing on various aspects of five primary areas of redox biochemistry: Antioxidant molecules and redox cofactors; Antioxidant enzymes; Redox regulation of physiological processes; Pathological processes related to redox.
3. Understand redox enzymology, mycobacterial drug targets, immunology, neurophysiology and oxygen sensing, and will understand the role of redox biochemistry in medicine.
4. Understand the important aspects of Hydrogen peroxide as major redox metabolite operative in redox sensing, signaling and redox regulation.

M.Sc. Life Sciences IVth Semester Course Title – Microbial Biotechnology

Code - L.Sc. – 4006

Course Outcome(s)

Students

1. Shall learn advances in food safety, food security, value-added products, human nutrition and functional foods,
   plant and animal protection, and overall fundamental research in the agricultural sciences
2. Shall contribute/serve in disease prevention and therapy, diagnostics, agriculture and horticulture, food
   provision.
3. Could serve as human resource for the production of proteins and enzymes, medicinal, polymers, enzyme
   inhibitors, surfactants, bioherbicides, biopesticides, and many more agricultural and industrial industries.

M.Sc. Life Sciences IVth Semester Course Title – Nanobiotechnology

Code - L.Sc. – 4007

Course Outcome(s)

After completing this course students will be able

1. To explain about the background on nanoscience and its applications.
2. To understand the synthesis of nanomaterials and their application and the impact of nanomaterials on environment.
3. To apply their learned knowledge to develop Nanomaterial's.
4. To apply Nanotechnology and may apply their skills in research laboratories and pharmaceutical industries.

Semester - IV Course - M.Sc. Life Sciences Course Title – Hormone Action & Metabolic disorder

Code - L.Sc. - 4008

Course Objective(s)

Course Outcome(s)

1. Understanding the common endocrine disorders , metabolic regulations, their management
2. Describing new advances in medicine for treating the hormonal imbalance at different levels
3. Studying thoroughly the genetic and psychiatric abnormalities associated with metabolic changes

4. To study the chemical nature of hormones and its quantitative action in relation to different disorders
5. Analyzing the role of hormones as a regulatory factor in the living system, the neurotransmitters and their relation with some diseases and drug addiction

Course Title - Seminar	
Semester - IV Course - M.Sc. Life Sciences Code — L.Sc. — 4009	**Marks: 25**
Course Title - Dissertation	
Semester - IV Course - M.Sc. Life Sciences Course Code — L.Sc. — 4010	**Marks: 200**